

Titration Tango

13% of total										
Question	Titration 1	Titration 2	2.1	2.2	2.3	2.4	2.5	2.6	2.7	Total
Points	30	40	5	4	4	2	1	2	2	90
Score										

Procedure:

Part I. Dilution of Unknown Iron Ore Sample

Mass of simulated iron ore [mg] (Report the value on the label)	
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Part II. Direct Titration of Iron Ore Solution

Analysis Nr.	V ₁ [mL]
1	
2	
3	
Reported value V₁ [mL]	

Titration 1 (30 pt)

Part III. Titer preparation

Mass of calcium chloride dihydrate [mg] (MW = 147.0 g/mol) (Report the value on the label)	
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Part IV. Indirect Titration of Iron Ore Solution

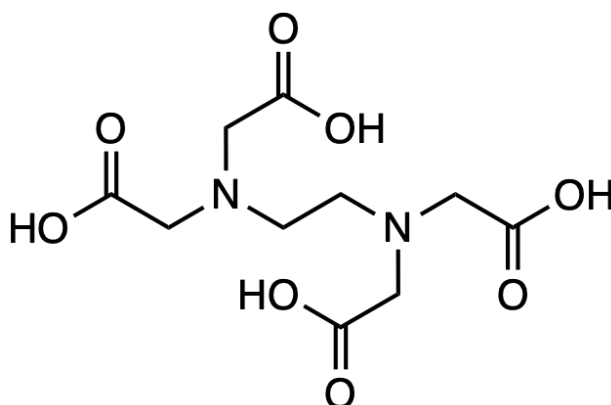
Analysis Nr.	V ₂ [mL]
1	
2	
3	
Reported value V₂ [mL]	

Titr.2 (40 pt)

Questions

2.1 (5 pt)

Provide the chemical formula of the resulting EDTA complex formed in the direct titration up to the equivalence point. The structure of EDTA is given below. In your chemical formula, abbreviate EDTA as " H_4Y ", its conjugate bases as " H_3Y^- ", " H_2Y^{2-} " etc. Hint: Under these conditions, one of the metal ions in solution preferentially forms an EDTA complex.



Structure of EDTA (equivalent to H_4Y).

2.2 (4 pt)

Calculate the mass percentage of iron(III) chloride (without water of crystallization), in wt.%, of the provided sample. The molar mass of FeCl_3 is 162.2 g/mol.

wt.%(FeCl_3) =

2.3 (4 pt)

Calculate the mass percentage of calcium chloride (without water of crystallization), , in wt.%, of the provided sample. The molar mass of CaCl_2 is 111.0 g/mol.

wt.%(CaCl_2) =

2.4 (2 pt)

Calculate the mass percentage of water of crystallization, wt.%, of the provided sample.

wt.%(H_2O) =

2.5 (1 pt)

Why is it necessary to keep the sample solution **A** at $\text{pH} < 2$?

Identify the correct answer among the four choices below.

- To chemically stabilize Ca^{2+} in solution
- To chemically stabilize Fe^{3+} in solution
- To reduce Ca^{2+} in solution
- To reduce Fe^{3+} in solution

2.6 (2 pt)

The solution you were given simulates the digestion of iron ore with concentrated HCl. Which of the following mixtures could be analyzed by the same procedure?

Identify the correct answer among the four choices below.

- Hematite (Fe_2O_3) + Limestone (CaCO_3)
- Magnetite (Fe_3O_4) + Chalcopyrite (CuFeS_2)
- Ilmenite (FeTiO_3) + Goethite ($\text{FeO}(\text{OH})$)
- Siderite (FeCO_3) + Dolomite ($\text{CaMg}(\text{CO}_3)_2$)

2.7 (2 pt)

Why does the sample for the indirect titration show a color change from blue to red regardless of the progress of the titration?

Identify the correct answer among the four choices below.

- Reduction of Fe^{3+} EDTA complex by ethanol
- Hydrolysis of Eriochrome® Black T under basic conditions
- Irreversible ligand exchange of Fe^{3+} EDTA complex by Eriochrome® Black T
- Eriochrome® Black T adsorption onto precipitated CaCO_3